15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: ENG68

Dynamics of logistic train

Wojciech Paszkowiak, Tomasz Bartkowiak

Abstract: A rapid development in intralogistics is the argument for seeking new solutions in this field. An example of such a solution is a logistics train. An important problem in the application of intralogistics trains is the choice of adequate parameters of the kinematic system and the possibility to check before the commissioning whether the train is able to pass the given path without a collision with surrounding objects. In this paper, we present a dynamic model of a logistic train which was developed for the three most common steering systems: virtual clutch and drawbar, conventional clutch and drawbar as well as double Ackermann steering. In the paper, we consider a three-wheeled tractor towing passive wheeled trailers. The tractor consists of actuated steering wheel at front and a two passive rear wheels used for stable motion. Two types of trailers are considered. First one is connected to the tractor via a passive joint and it has two rear fixed wheels and two caster wheels in front. The latter has front wheels that follow Ackermann steering principle. The turn of front wheels is caused by rotation of drawbar. The rear wheels are synchronized with front ones but they rotate in the opposite direction. Dynamic model was created following Lagrange's theorem including the possibility of lateral slip. In order to calculate the side-slip angle we used relation between relative velocities for a given wheel. Then, the system of differential equations was numerically solved. The results obtained are presented in the form of animations presenting train run in various conditions.

[1)] Wojciech Paszkowiak, M.Sc. (Ph.D. student): Poznan University of Technology, pl. Marii Skłodowskiej – Curie 5, 60-965 Poznań, Poland (PL), wojciech.z.paszkowiak@doctorate.put.poznan.pl , the author presented this contribution at the conference in the special session: "Dynamics of vehicles" organized by A. Harlecki.

[2)] Tomasz Bartkowiak, Ph.D.: Poznan University of Technology, pl. Marii Skłodowskiej – Curie 5, 60-965 Poznań, Poland (PL), tomasz.bartkowiak@put.poznan.pl .